TECHNOLOGY DEPT.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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No. 1265

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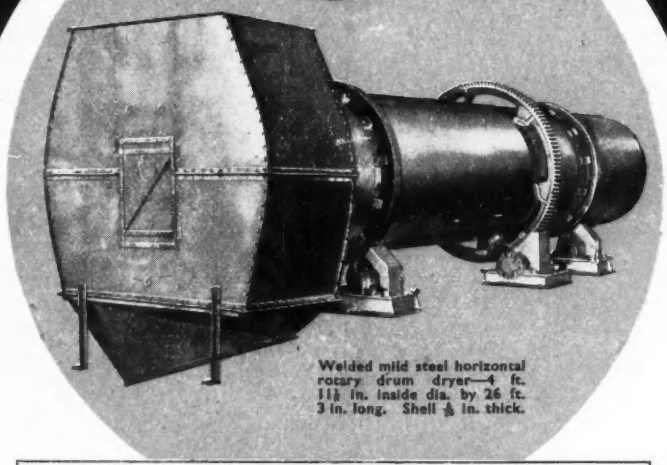

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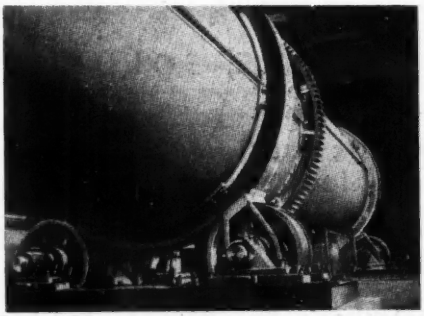

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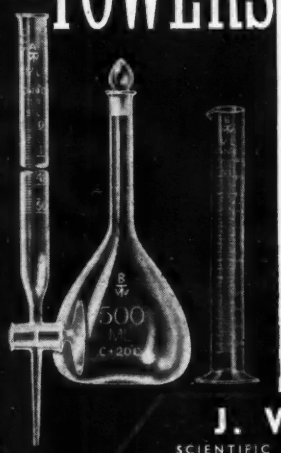

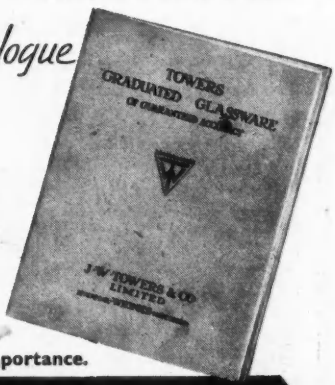

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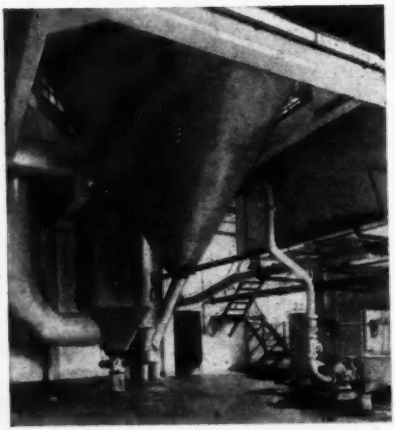

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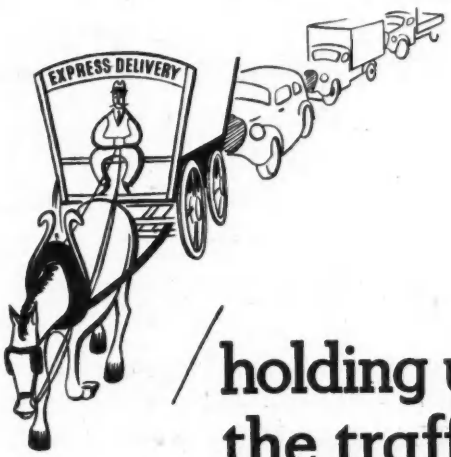

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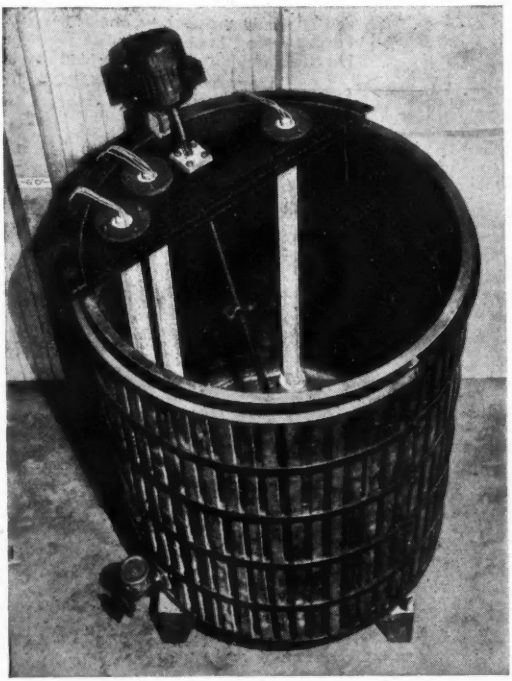

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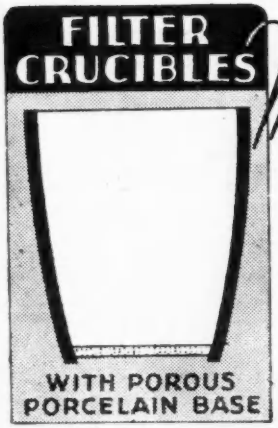

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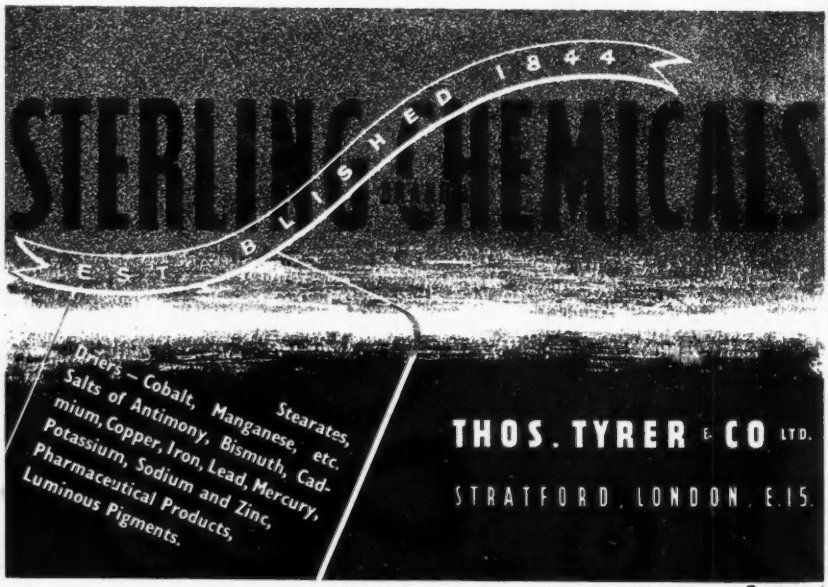

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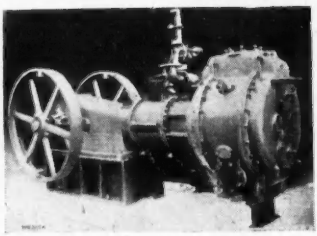

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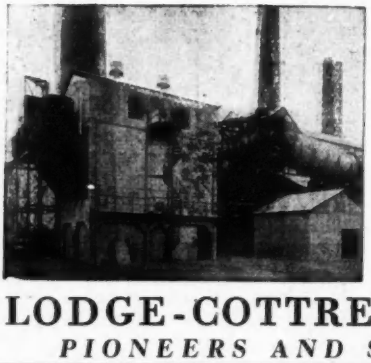

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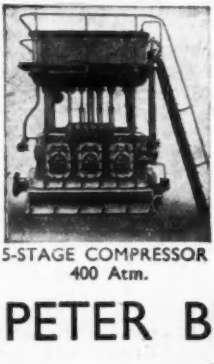

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Seaweed

SOME 60 years ago, Dr. Perkin took the chair at a meeting of the Royal Society of Arts at which Mr. E. E. C. Stanford drew attention to the many uses of seaweeds, and reviewed the methods then in use for obtaining from them such products as potash, bromides, and iodides. Now, in this present year, Dr. Marion Delf has brought our knowledge up to date with another paper to the same learned body. Seaweeds can be regarded from two angles: either as botanical growths of considerable interest and requiring no small amount of patience and perseverance for their study, or as a raw material for commerce. They present, pre-eminently, a case in which both aspects must be studied concurrently. The "harvest of the seas," as it has been called, is very far from being inexhaustible, and since most seaweeds seem to exist in that narrow space between low and high water, the conditions under which they can grow and prosper and the methods by which the "weed" can be grown must be discovered if the supply is not to fail almost before commercial developments have got under way. Industry has an insatiable appetite, and if any new industry is to be started, ample supplies of raw material must be available both for the modest output at the start, and for the far greater output which is likely to follow the success of the venture. In Dr. Delf's words: "If, as seems not unlikely, seaweeds may become an asset of some commercial importance, the conditions of their growth, regeneration, and harvesting must be more fully explored. In suitable localities and on suitable shores, it may be then worth while to cultivate the more profitable kinds. Something of the kind is indeed already being attempted on a small scale in the so-called fucus farms of Northern Ireland, where the harvest is utilised locally for manuring the fields. . . . At the present time, a number of research workers at Port Erin and elsewhere are engaged in studying the growth rate and reproduction of certain seaweeds of possible future importance with a view to their more rational harvesting and it is to be hoped that these and other investigations will be continued and expanded in post-war years." The progress that has been made in the study of seaweeds in Southern Ireland may be judged from Professor Thomas Dillon's article in our issues of to-day and of last week.

The commercial

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value of seaweed does not now depend on its content of iodine or potash, as it once did, but rather on its organic constitution. The higher plants are built up from cellulose (for herbaceous plants) and lignin (for woody plants). In seaweed, on the other hand, "the building materials are various mucilaginous and gelifying substances, cellulose playing little or no part in the composition of their walls. . . . It is these wall substances which promise to become of great commercial importance." The seaweeds are used for three main purposes: (a) in agriculture as a feeding stuff or as a manure, (b) for human beings as a food or medicine, and (c) for the manufacture of commercial products. There is no space here to follow the first two of these uses, and it is necessary to concentrate on the third. The manufacture of potash and iodine from kelp seems to have become discontinued as richer sources have become available. Interest is now focussed on the seaweed as a source of the mucilaginous substances. Of these there are two, one being from the brown algæ and the other, differing in composition, from the red algæ.

That from the brown algæ is extracted with boiling soda solution, and after filtering is acidified, when "alginic acid" separates. This appears to be a definite chemical substance, a polymer of *d*-mannuronic acid, which can polymerise to very large, long, molecules. The long and complex chain-structure leads to the possibility of using the polymerised material for the production of textile threads, and other similar uses. It has been found, for example, that it can be converted, by treatment with vulcanising agents such as CS_2 or CCl_4, into a rubbery mass which has been used for making typewriter rollers. By agitating the alkaline solution in presence of a little tannic acid, it emulsifies, and on pouring it on to a glass surface it gives a transparent film like cellophane, cheap, almost non-inflammable, and not much influenced by light. Alternatively, the purified alkaline extract of the fresh weed may be made into a viscous thread by being forced through a fine aperture into a bath containing a mixture of furfurol, NaOH, formalin, and other substances, producing a form of artificial silk which after being sized with an ammoniacal solution of algin under pressure can be spun into garments. The first thread so produced was not strong enough, however, but means appear to have been found of strengthening it by treatment with salts of chromium or beryllium. The Japanese claim to have produced artificial wool by spinning the thread into a bath which had a crimping effect. Dr. Delf further states that Messrs. "Albright and Wilson have been able to market a purified form of sodium alginate which has been given the trade name of 'Manucol.' . . . It is claimed that these powders or their derivatives have been utilised in connection with a variety of industries, including the production of food and medicines, and the manufacture of cosmetics, textiles, transparencies, and plastics. Alginates may be added to milk previous to the manufacture of milk powders; in this way the milk can be reconstituted by the addition of water, without causing sedimentation. . . . The colloidal properties of the alginates render them especially suitable as a base for creaming agents, for car polish, and even for boiler feeds to prevent the deposition of 'fur'."

From the red algæ are readily extracted mucilages and gels. The mucilages are dissolved out with cool water, the gels with boiling water. While seaweed glue has been manufactured, the more important and valuable product is the gel agar-agar, so widely used in connection with foods and medicines. Japan, and to some extent U.S.A., has been the main source of supply, but other nations are now investigating the possibilities of getting domestic supplies. Although some of the red algæ are to be found on our shores they do not appear to be in sufficient quantity for the production of agar-agar. No attempt has been made to cultivate them deliberately.

There would thus seem to be a clear case for careful investigation of the British seaweed position. If any commercial firm attempts to "exploit" seaweed without due precautions, the result will probably be that the existing seaweeds will be over-harvested and the venture will meet with disaster. On the other hand, a firm that is prepared to develop the deliberate cultivation of seaweed in conjunction with a specialist—officially described as an "ecological algologist"!—may well reap a rich harvest.

NOTES AND COMMENTS

A Watch on Fuel Economy

FUEL economy, as a subject of general conversation, is no doubt less in vogue than it was some six months ago. It is only human nature if we think less about such things during the comparatively mild spell known as summer in England. Nevertheless, in industry the subject remains a vital one, summer and winter alike, and the Ministry of Fuel and Power is performing a really important task in continuing to circulate its Fuel Efficiency Bulletins. The last batch we have examined (Nos. 17, 19, 21, 22) is particularly interesting, and really deserves more space than we are able to afford. However, we hope that a mere mention of their existence will be sufficient to make conscientious plant managers, etc., ensure that they get hold of them. No. 19, on *The Sensible Use of Latent Heat*, is the "serious" continuation of the imaginative No. 18, on which we commented some time ago. No. 17 gives useful pointers on the proper insulation of furnaces, and calls attention to the work that our refractory industry has done towards achieving this end. The most striking feature of No. 21—*The Construction of a Factory Heat Balance*—is the series of Sankey Diagrams, which show graphically the proportions of the heat input that are utilised and wasted. Comparable with an ordinary financial balance sheet and profit and loss account, they reveal the leaks in heat economy. The last bulletin, No. 22, is a sort of general summary on the utilisation of steam, and, as it were, supplements No. 21; when you've found the unjustifiable heat loss by means of your heat balance, it will tell you the possibilities of remedying the leakage.

Foundations of Canadian Chemistry

THE output of the Canadian chemical industries is one of the mainstays of the Allied war effort, and Canada's chemists are contributing towards victory as brilliantly as they did in the last war. We have just been reading an interesting account of how Canadian chemistry has progressed with the years: the story is told in a chapter by W. Lash Miller in a book called *A History of Science in Canada*. To-day, some of the biggest chemical plants in the world are situated in this Dominion; the chemical fraternity is a large one, the Canadian Institute of Chemistry, for instance, comprising 700 members. Canada's first chemist was probably Louis Hébert, an apothecary of the French court, who emigrated in 1604. Sixteen years before the *Mayflower* left our shores, he had set up lime-kilns and started a brewery. By the end of that century the Canadians were extracting maple syrup on a large scale, and making potash from the ashes of the trees they cut down in clearing the forest. The year 1738 saw the first iron furnace started, at St. Maurice, and this works operated for about a century and a half. The second period of chemical development dated from the arrival of Henry Holmes Croft in 1842. As a boy he had set up a laboratory under the stairway of his father's house, and his youthful enthusiasm for chemistry was encouraged by Michael Faraday, who induced the boy's parents to send him to Berlin to study under Mitscherlich and Rose. It was Faraday's recommendation which secured him the appointment, at Toronto, as the first professor of chemistry in Canada.

The Professor's Influence

BEFORE Croft's time there was only one active university in the Dominion; it took only a dozen years, however, from the time he went to Canada for all the present universities to be established (with two exceptions), some chemistry being taught in all of them. Between 1840 and 1870 gas works were started, a sugar refinery was built at Montreal, a sulphuric acid plant erected to meet the needs of the oil industry in Ontario, and a plant at Brokvil was making superphosphate from native rock. One of the phosphate mines employed a chemist, and it is believed that this man was the first Canadian to earn his living in that way. Factories to produce paper, bleaching powder, and cement were soon established, and by the time Croft resigned in 1879 chemistry had become established in all the universities and also in the schools. In 1883 the Canadian Pacific Railway, cutting through a hill near Sudbury, unearthed the first commercial nickel, which led to metallurgical development; to-day, the enor-

mous plant of the Consolidated Company is one of the largest mining and metallurgical enterprises in Canada, producing lead, zinc, gold, silver, copper, cadmium, bismuth, and antimony.

A Romance of Acetone

IN the last war Canada gave tremendous assistance to the Allies in the field of explosives production. By the middle of 1917, for instance, she was making 3,000,000 lb. of cordite and another 3,000,000 lb. of T.N.T. a month. There was a touch of romance about the way Canada started synthetic production of acetone from carbide. It was then a new process, and five young Canadian chemists worked day and night to perfect the technique whereby acetylene from calcium carbide (produced in Canada since 1904) could be transformed, step by step, into acetaldehyde, acetic acid, and finally acetone. Within one year over 1200 tons of this vital war material had been synthesised. During this war achievements fully as great as these are being performed in Canada, and we await with impatience the time when we can tell the full story of the part that the Canadian chemical industry played in the defeat of the Axis.

Chemists and Substitutes

HOW important, to-day, is a sound knowledge of the fundamental principles of chemical processes is a fact that is brought out clearly by the concluding sentences of Dr. Dorothy Jordan-Lloyd's lecture on "Leather," which has just been published by the Royal Institute of Chemistry. Only last week we referred to her explanation of the difficulties of dealing with certain leather supplies that reached this country; and these remarks were perfectly consistent with the general warning that she gave in her lecture. Even in normal times no two deliveries of the tanner's raw materials are the same, and since in war time materials used for empirical methods based on many years' experience are becoming less avilable, the possibility of adapting works practice to cope with the changes in the chemical process of tanning must be continually considered. The leather chemist, then, must be fully aware of the fundamentals of his mystery, and what applies to the leather chemist applies equally to all other works chemists. The uninitiated may smile in a superior way at substitutes, and stigmatise them as "ersatz": but, in fact, many a substitute material has been discovered to possess undisclosed good qualities, and perhaps to be superior to the "genuine article" in certain respects. It is the chemist's duty to make these discoveries, and, to do our works chemists justice, they have, in many instances, made this duty a pleasure. Few men become chemists unless they are interested in the job, and there is much professional satisfaction to be gained from making something work that would not work before. One only has to read the history of the British dyestuffs trade at the beginning of the last war to realise what can be done with a little chemical ingenuity.

Paint and Plastics

IN the discussion that followed the chairman's address at the recent general meeting of the Oil and Colour Chemists' Association, Dr. S. H. Bell, of the Paint Research Station, had some interesting remarks to make on the relations of paint and plastics. He is well qualified to speak, being closely connected, through another association, with the plastics industry. The industry itself, he said, was much concerned with the attitude of certain people who were suggesting that plastics could do anything and this attitude was decried by the bigger firms. One of the things, however, that plastics would do very well indeed was to bond plywood and a great deal would be heard about laminated plastics, bonded plastics and fabric film plastics. As regards what had been said concerning plastic finishes for decorative purposes and the undesirability of always having to live with the same colour, on the question of painting plastics there was a lamentable lack of knowledge. Many things would emerge from the work done during the war which would have a great bearing on the possibilities both of plastics and paint. This work linked up with tremendous developments in the use of oils and resins and other raw materials for synthesis. In this development in the post-war period the Paint Research Station must play a large part. Industry would not be disappointed with what would be revealed of its work when the time came.

Utilisation of Seaweed

Food and Fodder Values

by PROFESSOR THOMAS DILLON, University College, Galway

(*Continued from* THE CHEMICAL AGE, *September* 18, 1943, *p.* 283)

THE substances of possible commercial importance in the *Laminariæ* are alginic acid, laminarin, and mannitol, and it is therefore interesting to know the seasonal variation of these three bodies. A series of monthly determinations of each in *L. digitata* and *L. Cloustonii* has therefore been undertaken as part of the research on seaweeds financed by the Irish Industrial Research Council. The results of these determinations, which were carried out by Mr. P. O Muineachain, are shown in the curves in Figs. 4 and 5. They are published here by permission of the Council. The curves show that alginic acid is at a maximum in the spring and mannitol in the summer and that laminarin falls away almost to nothing in the winter and rises rapidly during the summer, to reach a maximum in the autumn. The difference between the two closely related species is remarkable. During the year in which the samples were taken, the alginic acid and the laminarin reached a much higher maximum in *L. digitata* than in *L. Cloustonii;* on the other hand, mannitol reached a higher maximum in *L. Cloustonii.* The maxima for all three constituents were reached earlier in *L. digitata* than in *L. Cloustonii.* These figures are in general agreement with the results published by Lunde for *L. digitata* gathered off the Norwegian coast in 1935 and 1936.[1] The figures here shown are, however, only for one year and no positive statement about the seasonal variation of the constituents can be made until determinations have been carried out over a period of at least three years.

As well as being a source of the carbohydrates mentioned above, the brown algæ may be used for the manufacture of wall-board. When the chopped weed is boiled first with acid and then with alkali, the partial decomposition of the alginic acid and other substances gives rise to a product which has properties somewhat like a cement. It is not fibrous; but when it is dried it sets to a hard mass. Wall-board may be made by reinforcing the cement with a fibre. The wet material is mixed with a small

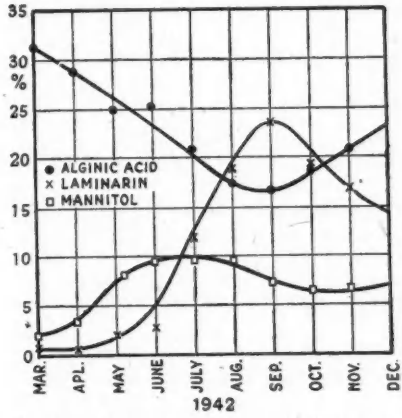

Fig. 4.—Seasonal variations in *Laminaria digitata*.

percentage of wood or straw pulp, the water is filtered off and the solid is pressed in a hot press. The board thus produced is of good quality and appearance, will hold nails and screws, and takes paint and varnish well.[8]

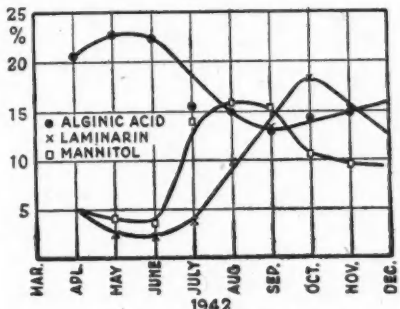

Fig. 5.—Seasonal variations in *L. Cloustonii*.

It has already been mentioned that certain seaweeds are used as human food. Seaweeds have also to some extent been

used, from time immemorial, as food for animals. In the west of Ireland carragheen moss is known to be a useful tonic for calves, and there are records from Ireland, New Zealand, Norway, Brittany, and Iceland of the spontaneous consumption of seaweeds by animals or of their use as fodder by farmers in times of scarcity. A certain amount of dry powdered *Laminaria* is exported from the west of Ireland to England, where it is incorporated in proprietary animal feeding stuffs. Its use in these cases appears to be not for the sake of the organic matter, but as a mineral supplement, through the high percentage of salts which it contains, and to supply iodine in districts where that element is deficient in the soil.

Investigations in France

The first attempt to obtain definite information about the food value of the brown algæ appears to have been made in France in 1918. The experiments arose out of an attempt made by the French General Adrian to feed horses on *Laminariæ* owing to the shortage of fodder caused by the war. Adrian's experiments were so promising that the Government (Direction des Inventions) requested Lapicque, and subsequently Sauvageau, to undertake a more systematic investigation. The general conclusions arrived at from these experiments were that the *Laminariæ* were highly digestible by horses after a short period (about 6 days) of habituation, and that the horses throve on the diet and actually gained in weight while working. Sauvageau suggests that the latter phenomenon indicates that the seaweed increased the digestibility of the other constituents of the rations. The dry matter of the *Laminariæ* contains about 20 per cent. of mineral matter and this large mineral content would appear to set a limit to the daily quantity of seaweed that could be fed to animals. As a matter of fact Lapicque[9] found that the urine of the horses fed on seaweed contained an extraordinarily large quantity of carbonate of lime as well as iodine up to one gram per day. Nevertheless prolonged feeding produced no ill effects. A horse weighing 400 kg. took 140 kg. of seaweed in 96 days without injury. In Sauvageau's experiments (*Utilisation des Algues Marines*, p. 322) a careful examination by a veterinary surgeon showed that the horses fed on seaweed remained in perfect health and that their appearance was actually improved.

In addition to the high mineral content there is another difficulty in the way of utilising seaweed as fodder, and that is its hygroscopic nature which encourages the growth of moulds on storage. By a simple treatment, Lapicque claims to have overcome both of those objections. *L. flexicaulis*, gathered in August and September, was steeped for a quarter of an hour in dilute lime water (4 or 5 grams of CaO per litre), and was then rinsed with fresh water for another quarter of an hour and air-dried. The moisture content of this air-dried material was 15 to 18 per cent., the mineral content 10 to 12 per cent., while laminarin constituted two-fifths of the dry weight. The material was not hygroscopic and could be stored like hay. Lapicque suggests that, treated in this way, the seaweeds of the French coast might provide the equivalent of a million quintals (about 50,000 tons) of corn per annum for fodder.

A Pig-Feeding Experiment

About three years ago the present writer, desiring to know whether laminarin was digested by animals, discussed the matter with Dr. E. J. Sheehy, Professor of Animal Nutrition in the Agricultural School of University College, Dublin, with the result that a digestion experiment on two pigs was undertaken. The results of this experiment were published in September, 1942.[10] The seaweed used in the experiment was *L. digitata* (also called *L. flexicaulis*) cut in September and dried, first in the air and then at 70° C., to a moisture content of 10 per cent. The weed was not, as in the French experiments discussed above, treated for the reduction of mineral matter. It was first cut into small pieces with a straw chaffer; but in this condition the animals would not eat it. It was then ground to a fine meal, when it was accepted at once. It may be mentioned here that in the French experiments the seaweed was cut into small pieces and was refused at first by the horses, who were persuaded to accept it only after two days of starvation. The proximate analysis of the seaweed meal

determined by the usual methods of agricultural analysis was as follows:—

Moisture	... ...	10.5 per cent.
Ash	... ...	14.66 ,,
Crude protein	...	7.00 ,,
Ether extract	... ...	00.36 ,,
Crude fibre	... ...	6.20 ,,
Nitrogen-free extract		61.28 ,,

It contained 15.2 per cent. of laminarin.

Digestibility Factors

The animals were kept in crates, as is usual in such digestion experiments, and the experiment was divided into three periods, during the first of which the pigs were given a basic ration complete and adequate for their maintenance. This basic ration consisted of a mixture of barley meal (40), wheat pollard (40), wheat bran (40), and meat meal (10), to which 1 part of salt was added. The total daily ration of each animal during this period was 1818 grams. During the second period, the salt was omitted and 600 gm. of seaweed meal was added to the daily ration. It was noticed that during this period the animals soon took on the gloss of coat and bloom skin indicative of good health. In order to discover whether a preliminary hydrolysis of the polysaccharides would increase its digestibility, the seaweed meal was replaced during the third period by 600 gm. of meal made from laminaria which had been boiled for an hour with 5 per cent. sulphuric acid and subsequently neutralised with soda. Each period of the experiment lasted for 16 days, during the last ten of which the fæces were collected and analysed. From analyses of food and fæces during each period, it was possible to arrive at the percentage of ingested seaweed that had been digested. The results showed that about one-quarter of the crude protein, about half of the "crude fibre" and about three-quarters of the "nitrogen-free extract" were digested by the pigs. No laminarin was found in the fæces. Hydrolysis of the weed did not improve its digestibility; in fact, the hydrolysed material gave slightly lower digestibility coefficients for all nutrient constituents than the untreated weed. The absence of laminarin shows that this carbohydrate is completely digested. Laminarin was not, however, the only digestible carbohydrate in the food. The seaweed contained 61.28 per cent of "nitrogen-free extract" or carbohydrate, of which only 15 per cent. was laminarin and, as already mentioned, about 45 per cent. of this was digested. Hence about 30 per cent. of other carbohydrates, including mannitol and alginic acid, was digested by the animals.

In considering the results of this experiment, it must be borne in mind that, apart from the ascertained fact that the laminarin was completely digested, the figures may not represent the true digestibility of seaweed. There is no doubt that seaweed exercises a beneficial effect on the digestive system and, as Sauvageau suggested in commenting on his own experiments, it may well have increased the digestibility of the basic ration, along with which it was fed. From the economic point of view, however, the results are the same so long as other suitable foods are fed along with the seaweed. Assuming that the figures found represent the true digestibility of seaweed, the total digestible nutrients of the sample used, which contained 90 per cent. of dry matter, work out at approximately 50. The corresponding figures for potatoes, hay and oats are respectively 19, 40, and 60. Thus *Laminaria* dried to 10 per cent. moisture and fed in conjunction with other suitable foods would appear to have, for pigs, a value approximately two and a half times that of potatoes and somewhere between hay and oats. Absolute conclusions cannot, of course, be drawn from a single digestion experiment on two animals; but the general agreement of these results with the experiences of Lapicque and of Sauvageau mentioned above as well as with those of Lunde[11] and of Ringen[12], who also conducted digestion experiments with *Laminariæ*, strengthens the conclusion that certain *Laminariæ* are rich in nutrient constituents.

Inferiority of Fucus

Dr. Senior has recently carried out, in Professor Sheehy's laboratory, comparative experiments on the digestibility by sheep of *Fucus* and of *L. digitata* gathered at different times of the year. The results of these experiments will shortly be communicated to the Royal Dublin Society. In the meantime, Professor Sheehy has privately communicated to me the following results obtained for the digestibility coefficients

calculated on the dry matter of the seaweeds: *Spring Laminaria,* 60; *Autumn Laminaria,* 67; *Spring Fucus,* 38; *Autumn Fucus,* 38. These results are interesting in view of the fact that Sauvageau appears to have found that *Fucus* was as suitable as *Laminaria* as a food for horses, whereas the above experiments show that for sheep *Fucus* has less than two-thirds of the food value of spring *Laminaria*. The superiority of autumn *Laminaria* is also interesting and is probably attributable to its much higher laminarin content.

Economic Factors

As to the economics of using seaweed as a food for stock, this would depend, not only on the cost of harvesting, but also on the cost of preparing and of grinding the seaweed, an item which is by no means negligible. Lapicque's prepared seaweed mentioned above, in which the ash is reduced to about 10 per cent. and the laminarin raised to 34 per cent. (15 per cent. moisture), would clearly be more digestible than the crude weed and, with its reduced mineral content, could probably be fed more freely to animals. About two and a half tons of air-dried autumn weed (35 per cent. moisture) would be required for the production of one ton of this feeding stuff, so that the cost of production would greatly exceed the cost of the raw weed, and the increased digestibility might or might not compensate for this increased cost. All observers, however, appear to be agreed on the beneficial effect of a seaweed ration on the health of animals and, whether or not a feeding stuff can be produced from it at a price which will compete with those already on the market, it seems likely that it will be used in increasing quantities when its nutrient qualities and its tonic effects become more widely known.

REFERENCES

7 LUNDE, *Angew. Chem.*, 1937, *50*, 731.
8 DILLON, FLOOD, BARRY and O MUINEACHAIN, Irish Pat. No. 15674.
9 LAPICQUE, *Compt. Rend.*, 167, 1082.
10 SHEEHY, BROPHY, DILLON and O MUINEACHAIN, *Econ. Proc. Roy. Dublin Soc.*, 1942, **3**, 150.
11 LUNDE, *Sk. and Vet.*, 1940, **30**, 26; *Nutrition Abstrs. and Revs.*, 1940, *10*, No. 1, 1033.
12 RINGEN, *Norges Landbrukshögskole Föringsforsökene*, 47 beretning, 1939.

The ASLIB Conference

Co-ordination of Technical Intelligence

THE Association of Special Libraries and Information Bureaux held its eighteenth conference on September 18 and 19. A large audience, which included visitors from the U.S.A. and enemy-occupied countries, filled the rooms of the Royal Society to capacity. The inaugural address was given by Mr. J. G. Crowther, Science Officer of the British Council, who spoke on "Information Services for the Scientist," in which a plea was made for the enlargement and co-ordination of information services as an integral part of the development of science, and for the establishment of an international centre for scientific information. Problems of library rehabilitation, an essential part of post-war reconstruction, were discussed by a number of speakers. Mr. Besterman proposed the establishment of an international library clearing-house which should be responsible for the collection and replacement of books and their allocation to libraries whose stocks have been depleted. This project has been referred to a committee under the auspices of the British Council and representative of the United Nations.

A prominent feature of the second day's proceedings was a general discussion on the co-ordination of abstracting. The general feeling was that, although a central abstracting service would be desirable, it could not replace the specialised abstracting organisations. The conference ended with a review of ASLIB's work, which has included the publication of book-lists and guides to specialised sources of information. Great demands have been made on the ASLIB inquiry service, and on their location-indexes to European periodicals.

PETROLEUM EQUIPMENT

The Council of British Manufacturers of Petroleum Equipment has been formed with three main objectives: (1) to collaborate with H.M. Government, and to speak authoritatively on behalf of the industry with the various interested Government departments: (2) to promote greater attention among British engineering firms to the oil companies' equipment requirements; (3) to acquire and disseminate among the firms interested up-to-date information regarding such equipment. At the first annual meeting the following officers were appointed: Mr. S. T. Robson, Head Wrightson & Co., Ltd., chairman; Mr. N. Matheson, Le Grand, Sutcliffe & Gell, Ltd., vice-chairman; Mr. C. R. Sams, Kent, Ltd., hon. treasurer; Mr. T. L. Bonstow, hon. secretary, 47 Parliament Street, London, S.W.1.

Atebrin and Plasmoquine*

Their Chemistry and Development

by ALFRED E. SHERNDAL

THE promotion of the manufacture of atebrin† and plasmoquine‡ in the United States is of paramount importance now, in order to meet the demand created by the situation of the Allied Nations in the war. The development of these drugs to their present status covers a period of about 23 years, dating back to 1920, when the systematic search for synthetic anti-malarials began in the Bayer research laboratories in Germany. During the following ten years of laboratory research and preliminary clinical examination, plasmoquine, in 1924, was the first promising synthetic to be produced, followed by atebrin in 1930. Since then no other products of equal importance have appeared.

In the period between 1930 and 1939, the two drugs were used clinically in wide areas, and became recognised and established for whatever value they possessed in malarial therapy. Late in 1939 the U.S.A. was faced with the problem of manufacturing them independently of any foreign supplies. We were poorly equipped to meet the suddenly increasing demands, and we were further handicapped by a lack of definite ideas as to how far those demands might eventually increase. Certain it is that no one imagined requirements reaching their present magnitude. But since 1939 there has been considerable development in the technique of the manufacture of these products in the United States, and a development in the scale of required production which could not then have been forecast.

The structural formulæ and chemical reactions involved in the synthesis of atebrin and plasmoquine have been lately so frequently shown and described that a repetition might seem superfluous. Several different procedures for preparing the products and their intermediates have been suggested and described in the original patents and in other literature. Passing over these, it might be of more pointed interest to describe in rough outline the procedures which are now actually being used for their manufacture in the United States. These now start from materials which are exclusively products of American chemical industry and resources.

The starting material for the acridine nucleus of atebrin is 2,4-dichlorobenzoic acid. To obtain this material was one of the chief difficulties in the early stages of our present manufacturing development. It was finally made and is still being made from the 2,4-chloroaminotoluenes, which were available in sufficient quantities from the dyestuff industry. Both isomers are usable for the purpose. They are converted by the Sandmeyer reaction to 2,4-dichlorotoluene, which by subsequent oxidation yields the required acid. Practically all the 2,4-dichlorobenzoic acid produced so far in the United States has been manufactured by this method, though some has been made by a similar procedure starting from 2,4-diaminotoluene. A third method is now going into production by which *p*-chlorotoluene is further chlorinated, the isomers separated, the 2,4-dichlorotoluene converted to the corresponding benzotrichloride which on hydrolysis yields the acid. A considerable part of the United States' requirements in 1943 is expected to be manufactured by this process.

The dichlorobenzoic acid is condensed in alkaline solution with *p*-anisidine, also available from the dyestuff industry, through its amino group, yielding a carboxylic acid in which the cyclisation is effected by means of phosphorus oxychloride. The reaction product is a methoxydichloroacridine in which one of the chlorines is readily replaceable by other groups.

Side-Chain Intermediate

For the aliphatic basic side-chain intermediate the starting material is diethylaminoethanol, which has been commercially available for some years and is also an intermediate for the local anæsthetic procaine. This alkamine is converted into its chloride by means of thionyl chloride. The diethylaminoethyl chloride is condensed with sodium ethylacetoacetate, forming an intermediate ester, which is not isolated as such but is hydrolysed and decarboxylated in the reaction mixture by heat. When the solution is made strongly alkaline, the resulting ketone separates out as an oil which is rectified by distillation in vacuum. In the next step the ketone is catalytically hydrogenated in the presence of ammonia, whereby the oxygen of the ketone group is replaced by NH_2, forming the aliphatic side-chain intermediate for atebrin.

The diamine and the chloroacridine are

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* Condensed from a lecture to the Detroit meeting of The American Chemical Society, reprinted in *Chem. Eng. News*, 1943, *21*, 14, p. 1154.

† *Atebrin* is the proprietary name of 3-chloro-7-methoxy-9-(1-methyl-4-diethylaminobutylamino)-acridine dihydrochloride. British, French and American equivalents are Mepacrine, Quinacrine and Atabrine respectively.

‡ *Plasmoquine* is 6-methoxy-8-(1-methyl-4-diethylaminobutylamino)-quinoline. British and American equivalents are Pamaquin and Plasmochin respectively.

heated together in anhydrous phenol. There is formed an intermediate phenoxy compound of the acridine which reacts readily with the diamine to form atebrin. The molten reaction mixture is poured into a large volume of acetone which holds the phenol in solution, while the atebrin is thrown out in the form of its dihydrochloride by adding excess hydrochloric acid. For purification, the product is dissolved in water and again thrown out as dihydrochloride by excess hydrochloric acid.

From this brief outline of the present manufacturing process in the United States, it can be noted that the materials and the reactions are all well known and straightforward. The over-all yields are fairly good. There is no resemblance to a "jig-saw puzzle," and there are no "secret ingredients" involved. Anyone can manufacture atebrin, and it could almost be said that everyone does or is about to do so. The reason is to be found in the present effort to meet the enormous demands to supply this anti-malarial drug to a large and, for us, an important part of the world's human population. The extent of this demand is even now straining the capacities of our already overburdened chemical industry. Under war conditions the strain may increase still further.

Plasmoquine has been rated lower than atebrin in importance, because its action is principally against the gamete or sexual form of the parasite, which is responsible for the transmission, but not directly for the symptoms of the disease. There are signs of increasing interest in the product as an adjunct to quinine or atebrin therapy.

Plasmoquine Manufacture

The starting point for its present manufacture in the United States is nitroaminoanisole, available from the dyestuff industry, from which the quinoline nucleus of plasmoquine is formed by the Skraup reaction. The nitro group of the resulting quinoline is reduced by iron to the amino group. The basic side chain which is then required to form plasmoquine is the same as in atebrin. However, it must be introduced through the amino group of the quinoline, and therefore the procedure differs from that used for atebrin. The same intermediate ketone is used in both cases, but in plasmoquine manufacture, this ketone is hydrogenated without ammonia, yielding the alcohol which is subsequently converted into its bromide by concentrated hydrobromic acid. Condensation of this bromide with the aminoquinoline forms plasmoquine base, which is isolated as an oil, rectified by distillation in a high vacuum, and then converted into an insoluble stable salt suitable for compressing into tablets.

Four years ago none of use would have considered malaria or synthetic anti-malarial drugs as of sufficient interest to warrant a symposium at a meeting of the American Chemical Society. Yet malaria was well enough known as an ancient and malignant disease, important particularly because of its economic aspects. Plasmoquine and atebrin were known to malariologists, and quite favourable reports about the value of the drugs had been extensively published from various parts of the world, including carefully controlled tests in the United States.

The final step in the synthesis of atebrin and plasmoquine had been carried out in the United States for a period of about six years from intermediates imported from Germany. But the demands for atebrin in the United States during the years 1933-39 were completely met by an annual production of abou 1,200 lb. or 5,000,000 tablets. Demands for plasmoquine were so small as to be negligible. The amount of quinine used throughout the world for malaria therapy was estimated at some 2,000,000 lb. or, with the usual dosages, sufficient to treat about 50,000,000 cases a year.

A Sudden Change

Such was the status of malaria and anti-malarial drugs in the United States up to the end of 1939 when the picture started to change rapidly. The change was due, of course, first to the outbreak of the war, and later to the complete stoppage of quinine supplies by enemy action, and still later to the widening field of military activity and the dependence of so many populations of the world on the United States for supplies of antimalarial drugs. The present importance of atebrin is due to the fact that we are faced with a lot of malaria, and atebrin is our only available dependable curative agent. Early in 1940 it was reckoned that 240,000,000 tablets per year would meet requirements. In the autumn of last year it was estimated that the requirements of the United States for atebrin could be met by 450,000,000 tablets per year, or 90 times the pre-war production. This goal had then already been met and was promptly exceeded. In December last it was announced that atebrin was being manufactured in the United States at the rate of 800,000,000 tablets a year, sufficient to treat 53,000,000 cases of malaria, which would be the equivalent of the total pre-war world supply of quinine. To-day we are producing atebrin at the rate of 1,200,000,000 tablets per annum.

Total production in the United States for the year 1943 is now scheduled to reach the astronomical figure of 2,500,000,000 tablets, or almost 7,000,000 tablets for every day of the year. There are indications that even these production levels may be insufficient to meet total demands. In order to accomplish this scheduled 1943 production, American pharmaceutical manufacturers must

produce six different intermediates to an aggregate amount of 3,000,000 lb., whose present use is limited entirely to the manufacture of atebrin, and they must draw on American chemical industry for some 25,000,000 lb. of other chemical materials as well as an array of special processing equipment. Chemists, laboratories, and a large group of manufacturers in the United States and England are now joined and collaborating in order to meet these extraordinary demands for atebrin.

Increased interest in plasmoquine as an adjunct to atebrin or quinine treatment is raising another production problem. The United States is already producing this synthetic at a rate of over one hundred times pre-war level. If clinical reports of its use continue favourable, we may expect greatly increased demands. It appears that even if the world's entire pre-war annual supply of 2,000,000 lb. of quinine were available to us, it would meet less than one-fifth of the present demands of the United States for anti-malarial drugs.

The Ideal not yet Reached

Malaria is a name given to a complex disease, complicated by the types of parasites and by the different forms which they assume during their life cycle. The term " anti-malarial " is far too general to define the specific rôle of any of our known remedies against the disease, and notwithstanding their enormous value to us at this time, the present synthetics apparently do not meet all the requirements which could be asked of an ideal anti-malarial drug. They have been criticised by some on the score of total efficiency and by-effects. But we may expect that the present intense activity in university and industrial research laboratories, and our rudely awakened recognition of the importance of malaria as a world disease, and the constant refinement of synthetic and biological methods, will eventually result in improvements in malaria therapy.

Universal Ingredients

The synthetic medicinals from our chemical laboratories do not depend for their production on restricted conditions. To manufacture them, it is not necessary to possess or control restricted areas of the earth's territory where soil and climatic conditions favour the cultivation and growth of any certain plantations. They can be manufactured wherever supplies such as air, water, oilfields, and salt mines are available to the chemist. Those requirements for manufacture are not readily controlled or restricted by national policy, war, or monopolies. It may well be that our future dependence for medicinal supplies will rest primarily with the chemical laboratory, and that drugs of plant origin may disappear or occupy a subordinate position in the treatment of disease. We have already found a number of synthetic drugs for certain purposes which surpass in medicinal value those obtained from natural sources. To discover and develop such aids in the fight against disease is the long-range task to which so many of our research laboratories have now devoted themselves.

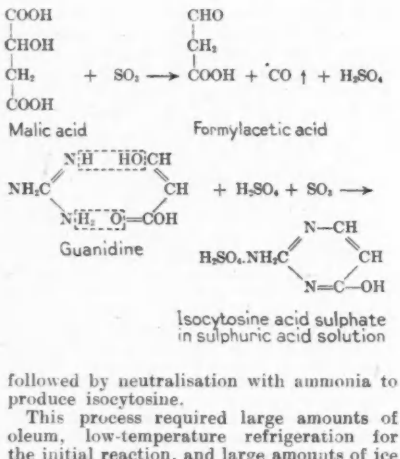
Sulphadiazine Production

Some Problems Surmounted

ANOTHER problem in the field of synthetic drugs which has been occupying the attention of American chemists is the production in increasing quantities of sulphonamides, particularly sulphaguanidine and sulphadiazine, to satisfy the demand of the Services and the general public for greater quantities at lower prices. In an article in *Ind. Eng. Chem* (1943, *35*, 8, p. 834) Mr. E. H. Northey, of the Calco Chemical Division, American Cyanamid Company, outlines some of the production problems that had to be solved, and at the same time pays a tribute to his colleagues, both chemists and chemical engineers, for their successful efforts towards solution and to the management for " having sufficient faith to gamble large sums of money " on the extensive research and development necessary. In particular he gives praise to the engineers who constructed the plant and continued to expand it in face of war conditions and constant changes of plan, and to the foremen who trained new men to meet continually rising production.

As to the chemical problems which were solved, only part of the story can be told now, because of government secrecy orders on the more recent developments.

The first pound of sulphadiazine was synthesised at the Stamford Laboratories of the American Cyanamid Company, took more than a month, and cost several thousand dollars. Much research was required to find out how to make the pound; as a matter of fact, the first gramme cost many times as much as the first pound. This laboratory work developed a method for making isocytosine, or 2-amino-4-hydroxy-pyrimidine, an essential intermediate in the manufacture of sulphadiazine, according to the following reactions:



followed by neutralisation with ammonia to produce isocytosine.

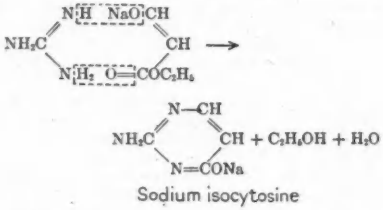
This process required large amounts of oleum, low-temperature refrigeration for the initial reaction, and large amounts of ice to drown the reaction mixture. The neutralisation with ammonia also required refrigeration, since the isocytosine was unstable in the presence of weak sulphuric acid. The high dilution of the neutralised solution led to serious solubility losses, so that yield was poor but apparently very much better than by any other scheme for making isocytosine then known. The therapeutic properties of sulphadiazine put extreme pressure on producing it as soon as possible. It was expedient to do what could be done quickly with the existing process and then push it into production, rather than take time to search for the best ultimate process. A major yield and quality improvement was worked out in the laboratory by drowning the reaction mixture in methanol instead of water. Isocytosine acid sulphate was almost insoluble in methanol so that it could be recovered by filtration.

Malic Acid Shortage

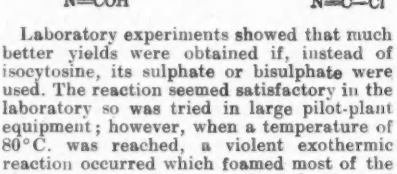
Construction of the sulphadiazine plant based on this process had advanced to partial completion when the sole supplier of malic acid reported a failure of the autoclave. Replacement of the autoclave, which was made of a special alloy, was out of the question for many months. This crisis forced investigation of other processes. After a few frantic days important improvements were discovered; the oldest process reported in the literature, which consisted of reacting ethyl formate, sodium ethylate, and ethyl acetate to form sodium formylacetic ester, was developed into a usable process. This had the decided advantage that it could be carried out in steel:

$$HCOOC_2H_5 + CH_3COOC_2H_5 + NaOC_2H_5 \rightarrow NaOCH{=}CHCOOC_2H_5$$

Sodium formylacetic ester



The next step in the process involved conversion of isocytosine to 2-amino-4-chloropyrimidine by reaction with phosphorus oxychloride:



Laboratory experiments showed that much better yields were obtained if, instead of isocytosine, its sulphate or bisulphate were used. The reaction seemed satisfactory in the laboratory so was tried in large pilot-plant equipment; however, when a temperature of 80°C. was reached, a violent exothermic reaction occurred which foamed most of the charge out of the vent, plugged it, and opened joints in the vent system which permitted enough phosphorus oxychloride to escape to drive everyone out of the shop. Needless to say, the pilot plant run was not repeated until large laboratory experiments had demonstrated how to control the reaction. It developed that sulphuric acid and phosphorus oxychloride reacted vigorously under the conditions, and that only a small fraction of the stoichiometric amount of sulphuric acid was required to give good yields of 2-amino-4-chloropyrimidine.

As originally developed at Stamford, the only satisfactory method of replacing the chlorine with hydrogen to give 2-aminopyrimidine was by catalytic reduction with hydrogen in the presence of barium hydroxide, using a palladium catalyst. This worked well in the laboratory, but when the first pilot plant batch of 2-amino-4-chloropyrimidine was made, all attempts to reduce by this method failed to give more than traces of 2-aminopyrimidine. Obviously some impurity was poisoning the catalyst, but attempts to purify were of no apparent avail. The literature indicated that dechlorination was possible with zinc dust, but the yields were almost microscopic. This was verified when the reduction was carried out either neutral or acid. It was found that moderately good yields could be obtained if reduction was in the presence of a base. By further experimentation, including addition of ammonia to the reduction mixture, further improvements in yields were made. Much of this work was purely Edisonian,

since there was little background of experience and theory to draw on. Isolation of the very soluble 2-aminopyrimidine from the zinc-reduction mother liquors introduced further problems.

The conversion of 2-aminopyrimidine by reaction with acetylsulphanilyl chloride and then hydrolysis to sulphadiazine was done by methods previously worked out for sulphapyridine and sulphathiazole. The nature of these heterocyclic bases requires that the condensation with acetylsulphanilyl chloride be done in dry pyridine if reasonable yields are to be obtained. Hydrolysis of the acetyl group of the intermediate 2-(N^4-acetylsulphanilamido)pyrimidine is best carried out with sodium hydroxide, since hot mineral acids cleave the sulphonamide linkage to give sulphanilic acid and the salt of the heterocyclic base.

Success in overcoming obstacles can be gauged by the fact that production is now at a rate forty times that contemplated a little over two years ago.

LETTER TO THE EDITOR

"Master Key" Industries

SIR,—The Axis is broken and, although the toughest battles of the war are still before us, we must direct some of our thoughts and as much energy as can be spared towards preparing to play our part in the post-war world. British scientists must prepare to take a much larger share in the direction of public affairs and I wish to draw their attention to one or two points which need urgent consideration.

To those whose duty it has been to assist the war effort by producing scientific instruments and equipment for our laboratories one outstanding fact has caused serious concern. I refer to the almost total lack of understanding of elementary science among the many members of the Government and Civil Service whose duties have brought them in contact with technical matters, often for the first time. The war has exposed a definite and serious national weakness in this direction and many glaring examples could be quoted if the interests of security did not ordain otherwise. The peak of munitions production must have been retarded by at least a year by this official ignorance! Men with a purely classical training and often with an obvious contempt for scientific matters have been thrust into jobs where they have been expected to deal with problems needing a keen appreciation of scientific method. The result has frequently been a series of wrong decisions which have hampered the efforts of those who knew what should be done and were trying to do it.

Educational reforms are receiving much attention from various committees but there is little sign that science will be given the prominence that is essential if Great Britain is to maintain her position as a first-class power. The teaching of the principles of science is just as important as history or arithmetic and should be made compulsory in all secondary schools up to the age of 17.

The second point to which I wish to refer is the future of the scientific instrument and laboratory equipment industry. No war can be waged, and our industrial system cannot develop, without the aid of these small but vital industries. They are the "master key" industries which provide the tools with which our scientists work, as well as the means of directing the terrible instruments of war which they have devised. They are equally important for the winning of the peace, and yet, when this war began, we were still dependent on Germany for many of these supplies. Men who ought to have been working in British factories were trained in Germany to make instruments which were dumped here in order to prevent our manufacturers from building up the satisfactory technical organisation that we needed for war purposes. The old Safeguarding of Industries Act (Part I) was quite inadequate protection against the German policy originated by Bismarck after the Franco-Prussian war when he found that his armies were dependent on Great Britain for their optical instruments.

If Britain is to build up the intensely scientific industrial system which must be the foundaton of her national and economic strength in the future, these "master key" industries must be given complete protection and adequate encouragement This can only be done if all manufacturers of "master key" material will join hands with the scientists who use their products in order to prepare a joint plan for Government action at the earliest possible date. In the interests of future peace and of world reconstruction, this plan must include control or even prohibition of certain German production of "master key" material, co-operation with other countries to avoid unnecessary duplication of production where the demand is very limited, and exchange of information so that the results of research can be made available to every authorised factory without delay.

British scientists must be prepared to give their time and if necessary their money for the purpose of educating public opinion in these matters. I am anxious to hear from anyone willing to give active support along the lines suggested. It is impossible to go into details in the very limited space available for this letter.—Yours faithfully,

NORMAN SHELDON, A.R.C.S., F.I.C.,
Chairman,
British Chemical Ware Manufacturers' Association.

September 20, 1943.

Coal Research in America

Laboratory Plants for Liquid Fuel

GREAT Britain is not the only country in which a war-time fuel problem exists. Even in the United States there are shortages, and the U.S. Bureau of Mines is fully occupied in testing millions of tons of coal for the Army, seeking substitute fuels to replace those of which shortages exist, promoting the production of high-quality coke, advising on storage and combustion problems, and producing motor spirit and oil from coal. Continuance of these and other essential allied activities in the Bureau's programme for 1944 has been made possible through a Congressional appropriation of $375,000, according to a statement by Mr. H. L. Ickes, Secretary of the Interior.

A Comprehensive Programme

Under the head of scientific investigations, the Bureau will continue to test coal and coke for new blast furnaces, produce motor fuel and oil from coal by hydrogenation, study the substitution of colloidal, or coal-oil mixtures, for fuel oil, seek to prevent slag erosion of boiler tubes in electric power plants, and review the storage and combustion problems of war plants. The service functions include technical advice to other federal agencies on the installation, replacement, and operation of fuel-burning equipment, the sampling and inspection of fuel purchased for the Government, and the analysis of coal samples. Already handling all coal purchases for the Army, some 10,000,000 tons a year, the Bureau this year also will test water used in Army boilers, which accounts for the increase in the appropriation. Conversions from oil- to coal-burning equipment have fostered many new problems, including the necessity for testing the performance of new apparatus.

The Bureau's investigations on the gas-, coke-, and by-product-making properties of American coals are of direct aid to war industries, for the carbonising characteristics of new coals must be evaluated and yields of gas and such by-products as benzene for synthetic rubber and toluene for explosives must be determined. To improve the quantity, quality and uniformity of coke and assist coke-oven operators in solving their problems, the Bureau also has equipped a mobile field laboratory and sent trained engineers into the field.

A Bureau of Mines project holding perhaps the greatest current interest is the hydrogenation of coal and water gas to produce liquid motor fuel and fuel oil. War demands and the lack of adequate transport facilities, causing critical shortages of petroleum products in cerain sections of the United States, have focussed public attention on the diminishing discoveries of new oil fields. Secretary Ickes, who also is Petroleum Administrator for War, said recently that it is necessary " to develop, on a commercial basis, known methods of making liquid fuel from coal, lignite, or oil shale " in order to ensure adequate supplies for future use.

Coal reserves in the United States are virtually unlimited, and the objective of the Bureau's work is to determine which coals and which methods are the best suited for producing liquid fuels. One small laboratory-scale pilot plant for the direct hydrogenation of coal by the Bergius method is in operation, and the Bureau is ready to instal and operate an industrial-scale pilot plant if funds are provided. Another small laboratory-scale plant, which will synthesise oil by combining carbon monoxide and hydrogen by the Fischer-Tropsch process, is under construction at the Bureau's Pittsburgh Experiment Station. Research in this plant will provide the technical information needed for designing and constructing an industrial-scale pilot plant which will furnish the blue-print for commercial plants.

White Lead by Electrolysis

New American Patent

WHITE lead of constant particular composition may be made by electrolysis in a bifluid cell, according to U.S.P. 2,270,783. It involves the use of an anolyte capable under electrolysis of yielding a lead solvent, and containing a bicarbonate. A catholyte is used containing a carbonate which is altered during the course of the process by removal of carbonate ions. It involves carbonation of the catholyte in order to restore the carbonate ions. The regenerated catholyte is re-used. The composition of the precipitated white lead is controlled by reference to the bicarbonate ion concentration in the anolyte. The improvement consists of adjusting the bicarbonate ion concentration in the anolyte by subjecting the catholyte to excess carbonation, also by incorporating hydroxyl ions in the anolyte. These are in the form of a soluble metal hydroxide, and are so supplied that the amount of added metal ions of the hydroxide is not in excess of the amount of metal ions lost in the course of normal operation of the cell. The amount of metal hydroxide incorporated in the anolyte is sufficient to establish the desired concentration of bicarbonate ions. The addition of ions not entering into the composition of the precipitated white lead is not greater than the loss of such ions in the course of normal operation of the cell.

Personal Notes

DR. A. B. CRAWFORD, A.I.C., has been appointed Inspector of Factories, Lanarkshire district.

PROFESSOR H. S. RAPER, C.B.E., F.R.S., F.I.C., is to receive the honorary degree of LL.D., and MR. E. V. EVANS, O.B.E., F.I.C., the honorary degree of D.Sc., from the University of Leeds, next month.

MR. J. C. W. STEAD, A.I.C., who has been production manager with Cooper, McDougal & Robertson, Ltd., has been appointed manager of the Wellcome Chemical Works at Dartford as from October 1.

MR. A. FISHER, who has been assistant manager and works chemist at Bury (Lancs.) Corporation sewage works, has been appointed sewage works manager of the borough of Pudsey (Yorks.).

MR. F. H. SEDGWICK, consultant chemist, was among those elected to the committee of management of the Cosmetic and Toilet Preparations Trade Association of Great Britain, Ltd., at its first general meeting on September 15.

MR. J. RATCLIFFE, having taken up a new appointment at the South-East Essex Technical College, Dagenham, has resigned from the position of hon. secretary of the East Midlands Section of the Royal Institute of Chemistry. He has been succeeded in that post by MR. C. W. NORTH, B.Sc., F.I.C.

MR. G. E. WILSON, A.H.-W.C., F.I.C., has been appointed Divisional Chemist for Scotland in the Research Department of the L.M.S. Railway at St. Rollox, Glasgow. A native of Edinburgh, Mr. Wilson in 1927 was appointed assistant chemist in the St. Rollox laboratory and in 1938 was transferred to the Derby laboratory, where in the following year he was appointed Acting Senior Assistant to the L.M.S. Midland Regional Chemist.

SIR FRANCIS JOSEPH, Bart., K.B.E., D.L., chairman of the Government-owned United Kingdom Commercial Corporation and past-president of the Federation of British Industries, has accepted an invitation to be the first honorary president of the National Society of Caterers to Industry. He considers that it will be a matter of national importance to continue industrial canteens after the war and to improve them as will be possible with the removal of inevitable war-time restrictions.

Obituary

MR. KEITH BLUNDELL STRAW, A.I.C., chief inspector of explosives and gas examiner for Victoria, died in Australia on June 30. He had been associated with the Victorian Explosives Department since 1912, but during the last war was chief chemist at a large explosives and chemical factory in England.

From Australia is reported the death, on June 20, of MR. LESLIE BRADFORD, general manager of the Broken Hill Proprietary Co., Ltd. He was 65. His life work was metallurgy, and from the date of his graduation from the South Australian School of Mines in 1899 he worked on the metallurgical side of B.H.P. until 1920, except for a six-months break in 1906. His great achievement was the perfection of a preferential system of flotation for the sulphides of lead and zinc, which is now in universal use. In 1920-22 he worked independently in the U.S.A. and Australia, but he then rejoined his old company in a managerial capacity, and remained with it till his death.

New Control Orders

Natural Menthol

The Board of Trade, at the request of the Ministry of Supply and in consultation with the Central Price Regulation Committee, has made an Order fixing the maximum prices to be charged by importers, brokers, and wholesalers of natural menthol. The maximum price to be charged by importers and brokers is 75s. per lb. The maximum price to be charged by wholesalers is 95s. per lb. If, however, a wholesaler can prove that at at all times since March 3, 1939, he has supplied menthol to the retail trade, and can prove also that at the date of this Order coming into operation he had in his possession stocks for which he has paid more than 75s. per lb., and that he has notified the Central Price Regulation Committee of the amount of such stocks, his maximum price of 95s. per lb., may be increased, in respect of these stocks, by the difference between 75s. per lb., and the price he actually paid, so long as his price does not exceed 125s. per lb. This Order, the Natural Menthol (Maximum Prices) Order (S. R. & O. 1943, No. 1285), came into operation on September 20.

SCOTTISH POWER BOARD

In reply to a question in the House of Commons, the Secretary for Scotland stated that the Minister of Fuel and Power and he had appointed the following to be members of the North of Scotland Hydro-Electric Board: The Earl of Airlie (chairman), Mr. A. E. MacColl (deputy chairman), Mr. Neil Beaton, and Mr. Hugh Mackenzie, Provost of Inverness. The Central Electricity Board had appointed Mr. Walter K. Whigham to be their representative on the board. An Amenity Committee and a Fisheries Committee had also been constituted.

Prices of British Chemical Products

TRADE on the London chemical market has been fairly steady during the past week, with deliveries against contract commitments well up to schedule. Although the general movement continues along substantial lines, immediate delivery offers are restricted in many cases by the supply position. Values throughout the market display a firm undertone. In the soda products section there is a steady demand for caustic soda and bichromate of soda, with Glauber salts and salt cake in good request. Chlorate of soda is a good market with supplies scarce, while a moderate inquiry is circulating for acetate of soda and hyposulphite of soda. A generally tight supply position is the chief feature of the potash section. Steady deliveries of permanganate of potash are reported, while offers of solid caustic, bichromate, and yellow prussiate are quickly absorbed. There is a brisk inquiry for acid phosphate of potash. In other directions a steady inquiry is being put through for white powdered arsenic, formaldehyde (British-made), acetone, and the lead oxides. Glycerine is in active request, and a good demand is reported for alum lump and sulphur. A firm tone is in evidence in the coal-tar products market, there being a brisk demand for crude tar, creosote oil and the anthracene oils. There has been no change in the position of carbolic and cresylic acid, which are being taken up steadily against contracts.

MANCHESTER.—Contract delivery specifications for the general run of heavy chemicals on the Manchester market during the past week have been satisfactory, with the textile bleaching, dyeing and finishing trades making a fair contribution to the movement of supplies, and the other leading users also taking their quotas. So far as new business is concerned, replacement buying is going on steadily as the need arises and, on the whole, conditions in this respect are not unsatisfactory. There has been little change compared with recent weeks in the position of the by-product market and most of the light as well as of the heavy materials are finding a steady outlet at a generally firm range of prices.

GLASGOW.—In the Scottish heavy chemical trade there has been a slight improvement during the past week for home business. Export trade is still very limited. Prices remain firm.

Price Changes

Rises: Copper sulphate; formaldehyde; hydrochloric acid; potassium carbonate; rosin; various types of vegetable and animal oil.

Falls: Arsenic; barium chloride; carbon tetrachloride; cream of tartar; tartaric acid.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80%, technical, 1 ton £39 10s.; 10 cwt./ 1 ton, £40 10s., 4/10 cwt., £41 10s.; 80% pure, 1 ton, £41 10s.; 10 cwt./1 ton, £42 10s.; 4/10 cwt., £43 10s.; commercial glacial, 1 ton, £49; 10 cwt./1 ton, £50; 4/10 cwt., £51; delivered buyers' premises in returnable barrels, £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r.

Aluminium Sulphate.—£11 10s. to £11 15s. per ton d/d.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Carbonate.—£38 per ton d/d in 5 cwt. casks.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £19 10s. per ton. See also Salammoniac.

Antimony Oxide.—£111 to £117 per ton.

Arsenic.—For 1-ton lots, £42 to £45 per ton, according to quality, ex store. Intermediate prices for intervening quantities.

Barium Carbonate.—MANCHESTER: precip., 4-ton lots, £16 per ton d/d; 2-ton lots, £16 5s. per ton.

Barium Chloride.—98/100%, prime white crystals, £16 10s. to £19 10s. per ton, bag packing, ex works.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax, Commercial.—Granulated, £31 10s.; crystals, £32 10s.; powdered, £33; extra fine powder, £34; B.P. crystals £40 10s.; powdered, £41; extra fine, £42 per ton for ton-lots, in free 1-cwt. bags, carriage paid in Great Britain. Borax Glass, lump, £83; powder, £84 per ton in tin-lined cases for home trade only, packages free, carriage paid.

Boric Acid.—Commercial, granulated, £52 15s.; crystals, £53 15s.; powdered, £54 15s.; extra fine powder, £56 15s.; B.P. crystals, £61 15s.; powdered, £62 15s.; extra fine powdered, £64 15s. per ton for ton lots in free 1-cwt. bags, carriage paid in Great Britain.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£10 10s. to £14 per ton, ex wharf. Granulated, supplies scarce.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5½d. per lb.

Chromic Acid.—1s. 5d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Oxide.—Black, powdered, about £100 per ton.

Copper Sulphate.—£31 10s. per ton, f.o.b., less 2 per cent. in 2 cwt. bags.

Cream of Tartar.—£100%, £13 2s. per cwt., less 2½%, d/d in sellers' returnable casks.

Formaldehyde.—£25 to £26 10s. per ton in casks, according to quantity, d/d.

Formic Acid.—85%, £47 per ton for ton lots, carriage paid; smaller parcels quoted up to 50s. per cwt., ex store.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £4 to £5 per cwt., according to quantity; in drums, £3 19s. 6d. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 11d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d. per lb., according to quantity.

Lactic Acid.—Pale tech., £49 per ton; dark tech., 43½% by weight, £42 per ton ex works; barrels returnable carriage paid.

Lead Acetate.—White, 50s. 6d. to 52s. 6d. per cwt. MANCHESTER: £51 to £54 per ton.

Lead Nitrate.—About £47 per ton d/d in casks.

Lead, Red.—English, 5/10 cwt., £44 10s. per ton; 10 cwt. to 1 ton, £44 5s.; 1/2 tons, £44; 2/5 tons, £43 10s.; 5/20 tons, £43; 20/100 tons, £42 10s.; over 100 tons, £42 per ton, less 2½%, carriage paid, non-setting red lead, 10s. per ton dearer in each case.

Lead, White.—Dry English, less than 5 tons, £57; 5/15 tons, £53; 15/25 tons, £52 10s.; 25/50 tons, £52; 50/200 tons, £51 10s. per ton; less 5%, carriage paid. Ground in oil, English, 1/5 cwt., £69; 5/10 cwt., £68; 10 cwt. to 1 ton, £67 10s.; 1/2 tons, £66; 2/5 tons, £65; 5/10 tons., £63; 10/15 tons, £62; 15/25 tons, £61; 50/100 tons, £60 10s. per ton, less 5% carriage paid.

Litharge.—1 to 2 tons, £44 10s. per ton.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £18 15s. to £22 15s. per ton.

Magnesium Chloride.—Solid (ex wharf), £16 to £18 per ton. MANCHESTER: £15 to £17 per ton.

Magnesium Sulphate.—Nominal.

Mercury Products.—Controlled price for 1-cwt. quantities: Bichloride powder, 15s. 8d.; bichloride lump, 16s. 3d.; mercury oxide, red cryst., 20s. 9d.; red levig., 20s. 3d.; red tech., 19s. 11d.; yellow levig., 20s. 2d.; yellow tech., 19s. 7d.; sulphide, red, 17s. 9d.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 2s. 4d. per gal.; pyridinised 64° O.P. 100 gals., 2s. 5d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£60 to £65 per ton for ton lots, carriage paid, in 5-cwt. casks; smaller parcels would be dearer; deliveries slow.

Paraffin Wax.—Nominal.

Potash, Caustic.—Basic price for 50-100 ton lots. Solid, 88/92%, commercial grade, £53 7s. 6d. per ton, c.i.f. U.K. port, duty paid. Broken, £5 extra; flake, £7 10s. extra; powder, £10 extra per ton. Ex store, £3 10s. supplement. Liquid, d/d, £34 in lots of 1 ton.

Potassium Bichromate.—Crystals and granular, 7¾d. per lb.; ground, 8¾d. per lb., for not less than 6 cwt.; 1-cwt. lots, ¼d. per lb. extra.

Potassium Carbonate.—Basic prices for 50 to 100 ton lots; calcined, 98/100%, £66 15s. to £68 5s. per ton ex store, according to quantity.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 10d. per lb. for 1 cwt. lots; for 3 cwt. and upwards, 1s. 9½d. per lb.; technical, £7 18s. 6d. to £8 10s. 6d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, 5 cwt. to 7 cwt., casks, 1s. 6d. per lb., d/d; supplies scarce.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Soda, Caustic.—Solid 76/77%; spot, £16 7s. 6d. per ton d/d station.

Sodium Acetate.—£41 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6½d. per lb.; anhydrous, 6¼d. per lb., net, d/d U.K.

Sodium Bisulphite Powder.—60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£21 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£42 per ton, nominal.

Sodium Hyposulphite.—Pea crystals, £21 10s. per ton for 2-ton lots; commercial, £15 per ton.

Sodium Iodide.—B.P., for not less than 28 lb., 9s. 11d. per lb., for not less than 7 lb., 13s. 1d. per lb.

Sodium Metasilicate.—£16 per ton, d/d U.K. in 1-ton lots.

Sodium Nitrite.—£20 to £23 10s. per ton for ton lots.

Sodium Percarbonate.—21½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £25 to £28 10s. per ton d/d for ton lots. Tri-sodium, £26 to £30 per ton d/d for ton lots.

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salts).—£4 10s. ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. MANCHESTER: £4 15s. per ton d/d station.

Sodium Sulphide.—Solid, 60/62%, spot, £18 5s. per ton, d/d, in drums; crystals, 30/32%, £12 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton, for quantities of not less than 4 tons; ground, but not sieved, £15 10s.; ground and sieved, £17 15s. Controlled prices.

Sulphuric Acid.—168° Tw., £6 10s. to £7 10s. per ton; 140° Tw., arsenic-free, £4 11s. per ton; 140° Tw., arsenious, £4 3s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—3s. 1½d. per lb., less 5% carriage paid for lots of 5 cwt. and upwards.

Tin Oxide.—Snow-white, controlled material, about 330s. per cwt.; free (nominal), 400s.-500s. per cwt.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £34; green seal, £33; red seal, £31 10s.

Zinc Sulphate.—Tech., £20-£21 per ton, carriage paid, casks free.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 2d. to 2s. 1½d. per lb. Crimson, 2s. 2d. to 2s. 6d. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 3s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Bisulphide.—£34 per ton, according to quality, in free returnable drums.

Carbon Tetrachloride.—£44 to £49 per ton, according to quantity.

Chromium Oxide.—Green, 2s. ped lb.

India-rubber Substitutes.—White, 6 3/16d. to 10½d. per lb.; dark, 6 3/16d. to 6 15/16d. per lb.

Lithopone.—30%, £25 per ton; 60%, £31 to £32 per ton. Imported material would be dearer.

Mineral, Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.
Plus 5% War Charge.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosporic acid, per ton d/d farmer's nearest station, in October, £20 2s. 6d. Increased charge of 2s. 6d. per month up to March, 1944.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, October, £9 13s.; increased charge of 1s. 6d. per month up to March, 1944.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, in October: I.C.I. type "Special No. 1," £14 9s. Increased charge of 2s. 6d. per month up to March, 1944. Type "Special No. 2," none available until January, 1944.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £15 5s. per ton; granulated, over 98%, £14 10s. per ton. Surcharges for smaller quantities unless collected at warehouse or depots.

Coal Tar Products

Benzol.—Crude, 60's, 1s. 11d.; pure, 2s. 6d., per gal., ex works.

Carbolic Acid.—Crystals, 9½d. to 11½d. per lb. Crude, 60's, 4s. 3d. to 4s. 6d., according to specification. MANCHESTER: Crystals, 9¾d. to 11½d. per lb., d/d; crude, 4s. 0 4s. 6d., naked, at works.

Creosote.—Home trade, 6½d. per gal., f.o.r., maker's works; exports, 6d. to 6½d. per gal., according to grade. MANCHESTER: 6½d. to 9d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. MANCHESTER: Pale, 99/100%, 4s. 6d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 8d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 2d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, in 4-ton lots, in sellers' bags, £5 9s. to £8 9s. per ton, according to m.p.; hot-pressed, £10 5s. per ton, in bulk ex works; purified crystals, £19 to £35 per ton. Controlled prices.

Pitch.—Medium, soft, 46s. to 55s. per ton, f.o.b. MANCHESTER: 46s. per ton, at works.

Pyridine.—90/140°, 18s. to 18s. 6d. per gal.; 90/160°, 14s. MANCHESTER: 14s. to 18s. 6d. per gal.

Toluol.—Pure, 2s. 7½d. nominal; 90's, 1s. 11d. per gal. MANCHESTER: Pure, 2s. 7½d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 1½d. to 3s. 4d. per gal., according to grade, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Wood Distillation Products

Calcium Acetate.—Brown, £21 per ton; grey, £24. MANCHESTER: Grey, £24 to £25 per ton.

Methyl Acetone.—40/50%, £56 per ton.

Wood Creosote.—Unrefined, about 2s. per gal., according to boiling range.

Wood Naphtha, Miscible.—4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. per gal.

Wood Tar.—£5 per ton.

Intermediates and Dyes (Prices Nominal)

m-**Cresol** 98/100%.—Nominal.

o-**Cresol** 30/31° C.—Nominal.

p-**Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

p-**Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

o-**Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

p-**Toluidine.**—2s. 2d. per lb., in casks.

m-**Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON.—September 22.—For the period ending September 25, per ton, naked, ex mill, works or refinery, and subject to additional charges according to package and location of supplies: LINSEED OIL, crude, £50. RAPESEED OIL, crude, £60. COTTONSEED OIL, crude, £52 2s. 6d.; washed, £55 5s.; refined edible, £57; refined deodorised, £58. COCONUT OIL, crude, £49; refined deodorised, £49. PALM KERNEL OIL, crude, £48 10s.; refined deodorised, £49; refined hardened deodorised, £53. PALM OIL, refined deodorised, £55; refined hardened deodorised, £58. GROUNDNUT OIL, crude, £56 10s.; refined deodorised, £58. WHALE OIL, crude hardened, 42 deg., £51 10s.; refined hardened, 46/48 deg., £52 10s. ACID OILS—Groundnut, £40; soya, £38; coconut and palm-kernel, £43 10s. ROSIN, 30s. 6d. to 45s. per cwt., ex store, according to grade. TURPENTINE, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

General News

A verdict of Accidental Death was recorded at the Hammersmith inquest on Monday on John Knowles, a 19-year-old student who died as a result of an explosion in the chemical laboratories of the Royal College of Science.

A series of twelve weekly talks on applied science are to be broadcast by the B.B.C. under the title "Science at Your Service." The first will be given on October 1, and the list of lecturers is expected to include Sir Lawrence Bragg, Sir Edward Appleton, and Sir Charles Darwin.

A donation of £5000 has been given by Imperial Chemical Industries, Ltd., in response to the Oxford University appeal for the £250,000 needed to found a department of opthalmic research, the aims of the scheme being to reduce blindness in this country and attain a higher standard of eyesight.

A technical education scheme was outlined by Mr. G. A. Campbell, chairman of the technical education committee of the Oil and Colour Chemists' Association, at Manchester last week. He spoke of the lack of skilled laboratory assistants in this country, and of the need to provide a form of training to benefit this class of worker.

Three research workers of the U.S. Army suggest, in a letter to *Nature*, that penicillin may inhibit the activity of the enzyme, urease, in the human body, so offering an explanation for the observed fact that the amount of urea in the blood increases with the administration of penicillin.

The Bolts, Nuts, Screws, etc. (No. 3) Order, 1943 (S.R. & O. 1943, No. 1301), which comes into force on October 3, extends the price schedules for certain types of bolts, nuts, set screws and studs, which at present apply only to sale by makers, to cover sales by other classes of sellers. The basis of maximum prices of black bolts and nuts other than carriage bolts and nuts is changed from prices for the gross or cwt. to prices for lots of one hundred, and a new weight conversion table is added.

The Executive Committee of the F.B.I., recognising the importance of inquiries at present being undertaken by Sir Arnold McNair's Committee into the supply and the training of teachers, has passed a resolution emphasising the necessity of assuring a supply of teachers, in technical schools and colleges, having technical knowledge, up-to-date industrial experience, and ability to teach. It gives assurance of its most sympathetic consideration for any proposals calling for greater co-operation by industry in this matter.

From Week to Week

At the first general meeting of the Cosmetic and Toilet Preparations Trade Association of Great Britain, Ltd., which was held in London on September 15, the chairman, Mr. F. L. Blackwell, reported that an increase of 25 per cent. in membership over that of the old association had been recorded. He welcomed the suggestion that meetings should be held every two months.

Prices of imported animal fats, allocated to primary wholesalers and large trade users, for the eight-week period ending November 13, have been increased as follows: edible tallow (Empire), increased by £1 to £51 10s. per ton c.i.f. (45s. per ton extra in barrels or tierces); premier jus (S. American), increased by £11 to £62 15s. per ton c.i.f. in barrels or tierces duty paid.

The importance of chemical research in industry was the subject of a recent address to Bury (Lancs.) Rotary Club by Mr. C. R. Coleman. Research, he said, could be carried out in four ways: (1) by the firm direct; (2) by groups of firms subscribing to a joint research fund; (3) by a firm co-operating with a university; and (4) by the State. The great advantage of the last method was that the State could be commissioned to examine problems which no individual was directly interested in solving.

Foreign News

A new pulp-wool factory at Zwynaerde, Belgium, has been established by "La Seta" Fabrique de Soie Artificielle.

Copper production in Rhodesia in the first half of 1943 has been officially reported as 124,876 long tons.

The arrangement for the refund of duty on soda ash imported into British India has been extended for a further year from June 22, 1943.

The entire production of split and ground mica from the Majormica mines, Ontario, Canada, has been contracted for by British concerns.

Metol and hydroquinone have been added to the list of chemicals which may be imported into Ceylon under an open general licence.

Laboratory glassware made of 96 per cent. silica glass has recently been developed in America. It has a low thermal expansion, high softening point, and exceptional stability.

A "super-abrasive" capable of polishing tungsten carbide has been developed by South African scientists. It consists of powdered metal mixed with crushed diamond boart.

The Japanese are making plans, it is reported, to manufacture paper in Java, Dutch East Indies, from straw, kapok waste, and a variety of pine-wood. Paper was formerly imported into Java from Japan and Scandinavia.

A phosphate deposit has been discovered at Auberson near Sainte-Croix, Switzerland, which is about one metre thick and extends for over 2 km. Its exploitation is expected to yield about 500,000 tons of superphosphate a year, with 18 per cent. phosphorus content.

Canadian Steatite Co., Ltd., of Georgetown, Ontario, has been organised as a Government-owned company and will construct a new plant at Georgetown, the entire steatite output of which will be used by the Government.

A building block of non-glare glass has been patented in America, and assigned to Pittsburgh Corning Corporation. The block, the invention of G. M. Rapp, looks like an ordinary glass building brick but inside is fitted a non-glare screen.

A corundum mine, closed since the last war, has been reopened in South Carolina and is being worked by Withers, Inc., for the **Metals Reserve Company** of the U.S. Government. The quality is said to approach the best African grades.

Production of native sulphur in the United States last year reached a new record of 3,460,686 long tons, which was ten per cent. higher than the 1941 total. More than 83 per cent. came from deposits in Texas, and nearly the whole of the remainder from Louisiana.

Monthly output of rock salt from the mines at Salzhop in the Wrongrowitz district of Poland is reported by the technical press to have increased from 5000 to 19,000 tons since the German occupation. The tax payment to the German Treasury is said to amount to about 1,000,000 RM.

Alcohol from pulp-mill waste, with sulphite liquor as the raw material, is being produced at the industrial alcohol plant of the Ontario Paper Co., Ltd., Thorold, Canada. This is reported to be the first alcohol plant in the Western Hemisphere to make use of pulp-mill waste.

American production of lithopone declined in 1942 to 137,320 short tons, the lowest figure since 1938. Paint remained the largest use of lithopone, but increasing military uses of paint did not make up for losses in civilian paint markets. Lithopone paint markets were also said to have been adversely affected by a growing use of titanium pigments in the white pigment field. Shortage of drying oils used with lithopone in the manufacture of linoleum, and the declining production of rubber white goods forced a decrease in the amount of lithopone needed for these purposes.

Furnace carbon-black production in America was already 150 million lb. a year before the advent of synthetic rubber. Dr. I. Drogin, research director of the United Carbon Co., states that the present demand is now so great that manufacturing facilities have had to be increased to achieve an output twice as large.

Phosphate rock deposits at Myponga and Kapunda, S. Australia, are being worked by the Broken Hill Proprietary Co., Ltd. Test work on bulk samples is in progress at the Adelaide School of Mines to find whether the low-grade rock can be successfully concentrated or otherwise converted into a useful fertiliser.

A survey of the sources of the rare alkalis in the New England States, published by the U.S. Bureau of Mines, shows that spodumene—$LiAl(SiO_3)_2$—is the most plentiful lithium mineral in the area, occurring in the four principal states. Maine possesses the largest reserves of caesium and rubidium minerals. An estimate of the available quantities is included.

Transport officers of the U.S. Army were among a party which descended 3000 ft. at the Balmain Colliery, near Sydney, N.S.W., to inspect the source of the flow of methane gas now being used increasingly as a petrol substitute. Installation of pipes for bringing the methane to the surface is in progress, and three new compressors will soon be operating. The rate of yield has been reckoned as equivalent to about 2500 cu. ft. of gas for every ton of coal mined, which is reported to be equal to the highest recorded anywhere.

Forthcoming Events

Dr. J. R. I. Hepburn will lecture on "Alloy Deposition," at a meeting of the **Electrodepositors' Technical Society** at the Northampton Polytechnic, Clerkenwell, E.C.1, on **September 27,** at 6 p.m.

A meeting of the **Institute of Fuel** will be held on **September 30,** at 5.30 p.m., in the lecture theatre of the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2, when Dr. R. Lessing, F.I.C., M.I.Chem.E., M.Inst. Gas E., will present a paper entitled "The Rational Preparation of Coal," which will be followed by a discussion.

The Tennant Memorial Lecture of the **Society of Chemical Industry** will be delivered by Sir William Alexander, K.B.E., C.M.G., D.S.O., M.P., at 5.30 p.m. on **October 1,** in Merchants' Hall, George Square, Glasgow. The title of the lecture is "Charles Tennant." The chair will be taken by Dr. Cullen.

The first meeting this session of the Plastics Group, **Society of Chemical Industry,**

will be held in the rooms of the Chemical Society, Burlington House, Piccadilly, London, on **October 1,** at 2.30 p.m., when a paper on "The Microscopy of Plastics" will be read by Miss C. Gordon (Royal Aircraft Establishment).

The London Area Committee of the **Association of Scientific Workers** is holding a conference at the Essex Hall, Essex Street, Strand, W.C.2, on **October 2,** for the purpose of surveying and discussing the many questions of medical and nutritional relief in liberated Europe, and examining the technical measures that must be taken to deal with them. Dr. D. McClean will preside. Relief plans already set up by the Allied Governments will be described by Professor J. R. Marrack, Professor of Chemical Pathology, and representatives of various occupied territories will give accounts of the medical aid and food supplies that will be needed. The conference will start at 2.30 p.m. and end at 7 p.m., with an interval for tea from 4.30 to 5.15.

The London section of the **Society of Chemical Industry** is holding a meeting at 2.30 p.m. on **October 4** in the rooms of the Chemical Society, Burlington House, Piccadilly, when Mr. S. J. Johnstone, B.Sc., F.I.C., M.Inst M.M., will lecture on "The Organisation and Use of Technical Intelligence Services."

The Road and Building Materials Group of the **Society of Chemical Industry,** and the **Oil and Colour Chemists' Association** is holding a joint meeting at No. 1 Grosvenor Place, S.W.1, at 5 p.m., on **October 7.** Dr. V. G. Jolly, F.I.C., will lecture on "Progress in Paints and Painting."

The Bristol section of the **Society of Chemical Industry** meets at 6 p.m. on **October 7** to hear the jubilee memorial lecture by Sir Robert Robertson entitled "Diamond." This lecture will be delivered also to the meeting of the **South Wales Section** at 3 p.m., in the Lecture Theatre, University College, Cardiff, on **October 9.**

A meeting of the Northampton group of the British Section of the **Society of Leather Trades' Chemists** will be held at the College of Technology, Northampton, on **October 9,** at 2.15 p.m., when Mr. E. Waters, B.Sc., will read a paper on "Colorimetry, The Science of Colour Measurement."

A joint meeting of the **Microchemical Club,** the South Yorkshire section of the **Royal Institute of Chemistry,** and the **Sheffield Metallurgical Association** to be held at the Department of Applied Science, St. George's Square, Sheffield, on **October 9,** at 2.30 p.m., will be devoted to a symposium on "Microchemical Analysis." Papers will be presented by Drs. G. H. Wyatt and Cecil M. Wilson, and Messrs. C. Whalley, J. J. Stock, G. Ingram and W. B. Price. In conjunction with this meeting an exhibition and demonstration of microchemical apparatus is being arranged, to be open from 10 a.m. to 1 p.m. on the day of the meeting.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Satisfaction

KEENE'S LABORATORIES, LTD. London, S.W. (M.S., 25/9/43.—Satisfaction September 2, £2000, registered December 5, 1939.

Company News

William Briggs and Son, Ltd., announce a dividend on the 5½ per cent. and on the 6 per cent. cumulative preference shares for the half year to September 30.

International Paint & Compositions Co., Ltd., are maintaining the interim ordinary dividend of 4 per cent. in respect of the year 1943.

Lever Brothers & Unilever, Ltd., have declared an ordinary dividend of 5 per cent. (same) for 1942, payable on October 12. Net profit for the year is £6,028,834 (£5,835,589).

Imperial Chemical Industries, Ltd., are paying, for the seventh year in succession, an interim dividend of 3 per cent. on the ordinary stock in respect of the year ending December 31.

Fisons, Ltd., are paying, on September 30, half-yearly dividends on the 7 per cent. first preference shares (to June 30) and the 5 per cent. second preference shares (to September 30).

The Staveley Coal and Iron Co., Ltd., are paying a final dividend of 4 per cent., making a total of 6½ per cent. (same) for the year to June 30 last. Net profit is £273,211 (£271,634); forward £138,629 (£135,466).

Oxley Engineering Co., Ltd., announce a trading profit of £23,905 (£76,102) for the year ended June 30, and a net profit of £12,271 (£14,034). A dividend of 15 per cent. (12½ per cent.) is proposed. To general reserve £5000 (£4000); forward £6580 (£6809).

The National Fire Protection Co., Ltd., reported a profit for the year ended March 31, of £11,225 (£19,942), and announce an ordinary dividend of 6½ per cent. (5 per cent.). To tax, £9479 (£17,708); forward, £1635 (£1404). Since the date of the balance sheet the remaining ordinary shares have been issued, making the capital £20,000. Authorised capital has been increased by the creation of £10,000 7 per cent. preference shares, which the directors now propose to issue.

The Triplex Safety Glass Co., Ltd., has earned a net profit of £120,738 (£76,138) for the year ended June 30. This figure includes allowance for depreciation, but not for tax and N.D.C. The dividend is maintained at 10 per cent.

Cooper, McDougall and Robertson, Ltd., announce that, owing to the delay in receiving accounts from overseas subsidiaries, the accounts for the current period will cover the 15 months to December 31, instead of being made up to September 30. The half-yearly dividend on the 7 per cent. preference shares will be paid as usual on September 30.

The Leeds Fireclay Co., Ltd., announces a distribution of 4 per cent. on ordinary shares for the year ended June 30. The last ordinary dividend was a payment of 5 per cent. for the year to June 30, 1938. A final dividend of 3 per cent. (making 6 per cent.) on the 6 per cent. non-cumulative preference shares is also announced, the previous payment in this class having been 4 per cent. for the year to June 30, 1940.

New Companies Registered

Nepro, Limited. (382,757).—Private company. Capital: £100 in £1 shares. Manufacturing, research, and analytical chemists and druggists, etc. First directors: J. H. Hill and M. Hill. Registered office: 6 Needham Avenue, Manchester 21.

Pesticidal Services (Scotland), Ltd. (382,661).—Private company. Capital: £1200 in 1200 shares of £1 each. Manufacturers of and dealers in insect, rodent and pest destroyers, etc. Directors: T. A. Acton, 1 Moat Drive, Ruislip, Middlesex; S. Mattana; N. B. Phillips.

Igma Manufacturing and Trading Company, Ltd. (22,530).—Private company, registered in Edinburgh. Capital: £100 in 100 shares of £1 each. Manufacturers of and dealers in chemicals, gases, drugs, etc. First director: A. B. McCartney. Registered office: 58 West Regent Street, Glasgow.

Advance Technochem, Ltd. (382,636).—Private company. Capital: £500 in 500 shares of £1 each. To encourage research into, and to commercialise and exploit techno-chemical processes, to manufacture and produce from natural or synthetic products raw of finished materials for industrial or domestic use, etc. Directors: C. H. Warburton, Marjorie Burton. Registered office: Martin's Bank Chambers, 37 English Street, Carlisle.

Alibyn Products, Ltd. (382,698).—Private company. Capital: £1000 in 1000 shares of £1 each. To acquire inventions relating to solder, welding rods, jointing and insulating materials, fluxes and chemical compounds: manufacturing chemists, manufacturers of scientific preparations and articles, motor, welding and general engineers, etc. Directors: H. O. Ormiston; B. E. Thompson. Registered office: 14 Greyhound Lane, London, S.W.16.

Talc Importers' Association, Ltd. (382,696).—Registered as a company limited by guarantee, without share capital. To constitute an association of persons interested in the import of talc in powder, lump or cut pieces, including pyrophyllite, but not asbestine, for the purpose of co-operating with and acting as agents for H.M. Government for the purchase of talc and other minerals and their allocation and distribution to users and consumers, to carry on the business of warehousemen, commission agents, merchants and distributors, etc. Members are classed as "A" and "B", according to the periods on which their "basic tonnage" is calculated. Directors: W. W. King; W. G. Moyers; A. B. Rayner; L. Baines; C. C. Hallett. The three first-named represent the "A" and the two last-named "B" shareholders. Registered office: K30 Exchange Buildings, Exchange Flags, Liverpool.

Chemical and Allied Stocks and Shares

WITH sentiment aided by the war news, the undertone in Stock Exchange markets has been firm, although in most sections, the volume of business showed no marked improvement. Imperial Chemical, although "ex" the interim dividend, were 38s. 7½d. or within 1½d. of last week's level. Maintenance of the interim at 3 per cent. was in accordance with general expectations, and it is generally assumed that there are good prospects of the total payment for the year remaining on an 8 per cent. basis. Lever & Unilever, "ex" the dividend which is again limited to 5 per cent., were 36s. 6d., or 6d. lower on balance; sentiment was aided by the improved profits, and by the assumption that after the war a less conservative dividend policy will be followed. It is apparent from the preliminary figures, that the 5 per cent. payment is again much below the rate actually earned on the ordinary capital.

Triplex Glass 10s. ordinary, another share valued mainly on the prevailing views as to scope for recovery in dividends after the war, were slightly lower on balance at 38s. 6d.; profits last year improved substantially from £76,138 to £120,738, but the dividend is again limited to 10 per cent. Leeds Fireclay 10s. ordinary changed hands up to 8s. 3d. on the resumption of dividends with a 4 per cent. payment; the preference shares have transferred up to 19s. at the time of writing. Elsewhere, Burt Boulton maintained their recent improvement to 20s.,

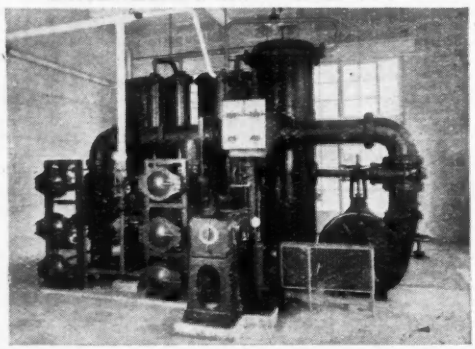
awaiting the financial results. William Blythe 3s. shares, which have shown more markings of business recently, changed hands around 9s. Dealings up to 3s. 6d. were recorded in British Emulsifiers 2s. ordinary, at 9s. 6d. in British Tar Products 5s. ordinary, at 7s. 6d. in Greeff-Chemicals 5s. ordinary, and British Industrial Plastics 2s. ordinary were dealt in at prices between 6s. 9d. and 7s. Erinoid 5s. ordinary remained at 12s. 6d., awaiting the dividend announcement, while Thomas De La Rue were quoted at 158s. 9d. A firmer tendency developed in Imperial Smelting at 15s. 3d., while General Refractories were 18s. 1½d.

There was, however, a certain amount of profit-taking in Wall Paper Manufacturers deferred following their recent rise, and there has been a partial reaction to 42s. 6d. at the time of writing. Firmness was shown in the units of the Distillers Co. at 90s., while United Molasses were quoted at 31s. 1½d. Elsewhere, Murex were 101s. 10½d. awaiting the financial results. Turner & Newall at 79s. 3d. have regained an earlier small decline, and were unchanged on balance.

In other directions, British Plaster Board improved to 28s. 9d., and British Oxygen at 80s. 6d. more than maintained last week's rise. On the other hand, British Aluminium were 47s. 9d. xd. compared with 49s. a week ago. Shares of companies with retail interests were favoured, and Timothy Whites & Taylors 5s. ordinary moved up to 33s. 1½d. compared with 31s. 1½d. a week ago. Boots Drug 5s. ordinary were higher at 43s. 6d. Elsewhere, Sangers further improved to 23s. 10½d. Beechams deferred were firm at 17s. 6d. " ex " the higher interim payment.

B. Laporte remained firm at the higher level of 80s. awaiting the interim dividend, due shortly. W. J. Bush were also held firmly, and were quoted at 55s., while Monsanto Chemicals 5½ per cent. preference were 23s. 6d. In other directions, Dunlop Rubber remained at 40s.; Courtaulds eased from 55s. to 54s. 9d., and British Celanese were 32s.; financiall results of the last-named company are due next month. Barry & Staines at 43s. 6d. were the same as a week ago, as were Nairn & Greenwich at 68s. 9d. In the iron and steel section, Dorman Long were well maintained at 27s. 4½d., and Stewarts & Lloyds deferred moved higher to 53s. 3d., while Tube Investments held their improvement to 93s. United Steel were 25s. 1½d. (the results are due shortly), and Richard Thomas 6s. 8d. ordinary moved up to 10s. 9d. Allied Ironfounders, however, eased to 49s. 6d. Sheepbridge ordinary were firm at 45s. 9d. on the higher earnings shown by the results. Shell, Anglo-Iranian, and other leading oil shares moved higher. United British Oilfields of Trinidad 6s. 8d. shares rose to 17s. 3d. under the influence of the improved figures for the past year's working.

BENZOLE RECOVERY



A Plant which extracts

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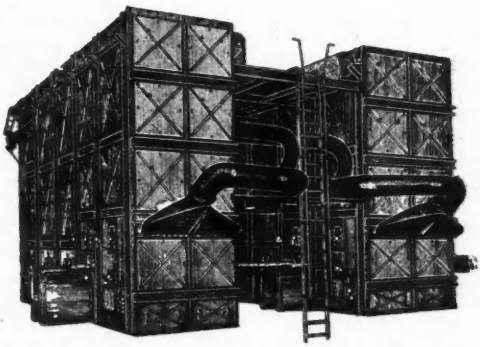

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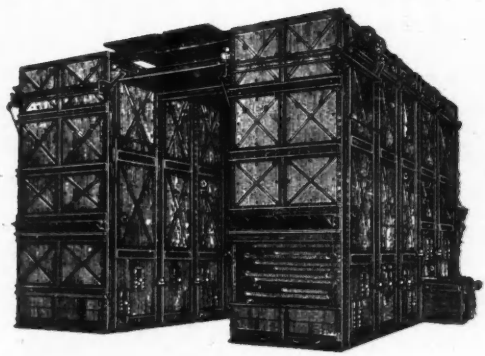

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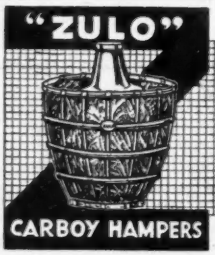

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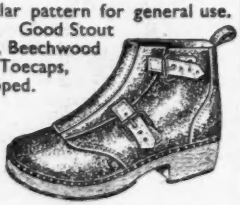

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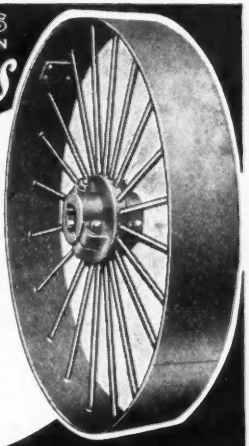

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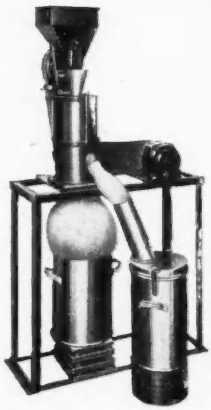

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